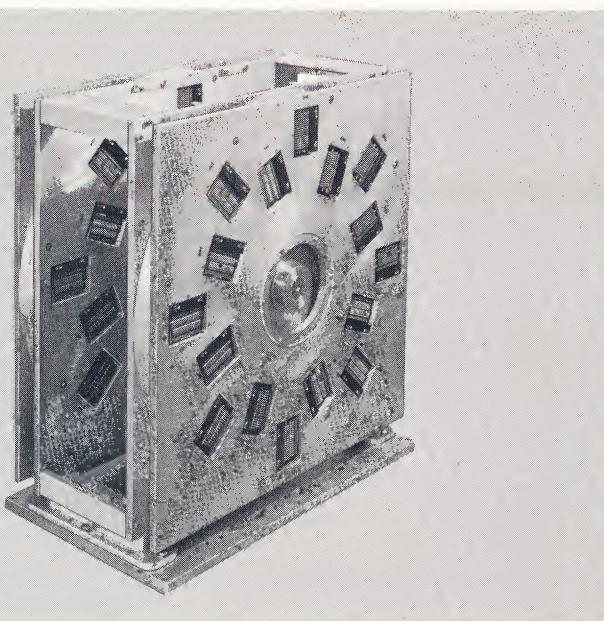




LIBRASCOPE engineering data



SERIES L-400

magnetic- disc memory systems

DESCRIPTION—Librascope's Series L-400 Magnetic-Disc Memory Systems are designed to provide data storage and transfer in computer systems, peripheral equipment, and other systems in which rapid-access memory is a requirement. Series L-400 consists of two models: the L-414, a single-disc memory file and the L-424, a two-disc memory file.

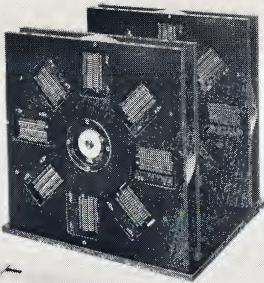
Both models feature a flying-head per track and a non-wearing, plated-cobalt recording surface. This provides outstanding magnetic performance under all operating conditions.

SPECIAL FEATURES—A disc is mounted on each end of a double-ended motor that contains precision, preloaded bearings. Thus, both sides of each disc are accessible for service and mounting of recording heads. Special construction of the disc assembly also permits individual discs to be replaced without readjusting head units. The recording disc surface, plated with a cobalt coating, is smooth and long-wearing. This enables the disc to perform perfectly, despite multiple starts and stops. The flying head is in contact with the metallic recording surface when the disc is not rotating. The inherent hardness of the cobalt plating provides high resistance to abrasive wear and relative insensitivity to accidental damage.

All materials, tolerances, and design proportions of the basic structure are selected to compensate for the temperature differentials that the disc assemblies may encounter in storage and during operation. The discs and supporting structures are made of aluminum to provide strength, rigidity, and lightness of weight.

The advanced, yet simplified, design of the disc and head results in more efficient packaging. This provides the user expanded, or "add on," memory capability at lower cost-per-unit volume.

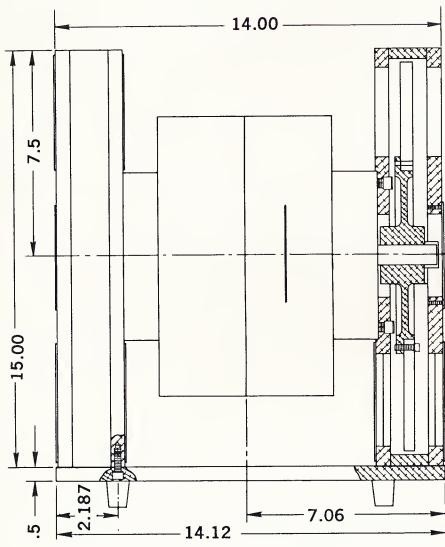
APPLICATIONS—Disc memories are used in computer systems and peripheral equipment as the main storage or buffer storage. Or, they supplement other memories. In a typical computer system, a magnetic disc memory provides inexpensive, rapid-access reliable storage with a capacity for many programs. In peripheral equipment, such as visual computer displays, they make possible a constant (no-flicker) variable-size display.



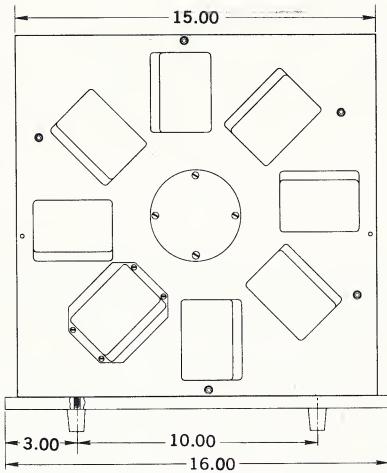
SERIES L-400

model L-414

MOTOR ASSEMBLY



TOP PLATE



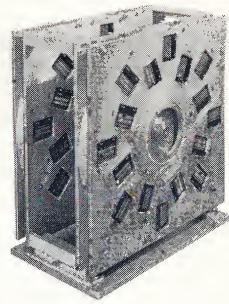
GENERAL CHARACTERISTICS

**Model L-414
Magnetic-Disc Memory System**

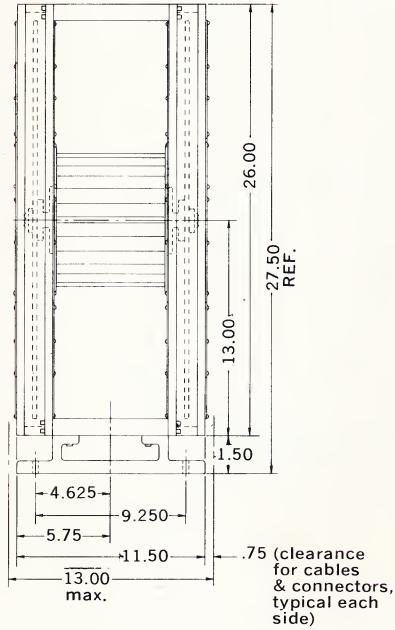
Number of tracks (basic unit): (including timing as required)	512
Bits per track: (phase modulation, 2 flux changes per bit time)	Up to 16,384
Total storage capacity: (phase modulation recording)	8,388,608 bits
Recording diameters:	8.5" to 13.5"
Disc diameter:	9" to 14"
Disc speed:	1800 to 3600 RPM
Power requirements:	To be specified for specific requirements
Recording surface:	Proprietary plated cobalt
Head type:	Aerodynamic, 16 tracks per bar, center tapped bifilar winding
Head inductance:	Up to 60 microhenries per half winding, according to system requirements
Repetition rate:	Up to 983 KC @ 3600 RPM at 613 B.P.I.
Average bearing life:	10 years
File size:	15" wide 15" high 12" deep
Weight:	Approx. 80 pounds
Magnetic characteristics: Bit density (max.):	613 B.P.I.
Signal amplitude:	60 MV min. at 3600 RPM
Write current: (max. for saturation)	30 MA peak with 60 uh head Readback from all tracks are within a ratio of 4 to 1 with playback of 60 MV minimum with 60 uh head
Modulation:	Maximum modulation of any recorded track is 15% Modulation percentage is defined as: $\frac{2 \times (\text{max. output} - \text{min. output})}{(\text{max. output} + \text{min. output})} \times 100$

SERIES L-400

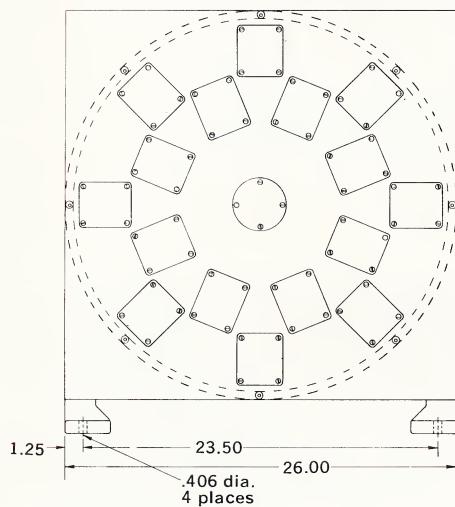
model L-424



MOTOR ASSEMBLY



TOP PLATE



GENERAL CHARACTERISTICS

Model L-424
Magnetic-Disc Memory System

Number of tracks (basic unit): (including timing as required)	1024
Bits per track: (phase modulation, 2 flux changes per bit time)	Up to 26,400
Total storage capacity: (phase modulation recording)	27,033,600 bits
Recording diameters:	13.5" to 23.5"
Disc diameter:	14" to 24"
Disc speed:	900 to 1800 RPM
Power requirements:	To be specified for specific requirements
Recording surface:	Proprietary plated cobalt
Head type:	Aerodynamic, 16 tracks per bar, center tapped bifilar winding
Head inductance:	Up to 60 microhenries per half winding, according to system requirements
Repetition rate:	Up to 762 KC @ 1800 RPM at 600 B.P.I.
Average bearing life:	10 years
File size:	26" wide 27 1/2" high 13" deep
Weight:	Approx. 280 pounds
Magnetic characteristics: Bit density (max.):	600 B.P.I.
Signal amplitude:	60 MV (min.) at 1800 RPM and highest packing density with 60 uh head
Write current: (max. for saturation)	Nominal 30 MA peak with 60 uh head Readback from all tracks are within a ratio of 4 to 1 with playback of 60 MV minimum
Modulation:	Maximum modulation of any recorded track is 15% Modulation percentage is defined as: $\frac{2 \times (\text{max. output} - \text{min. output})}{(\text{max. output} + \text{min. output})} \times 100$



SERIES L-400

magnetic- disc memory systems

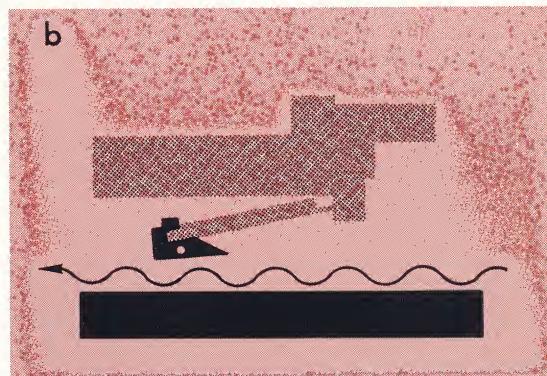
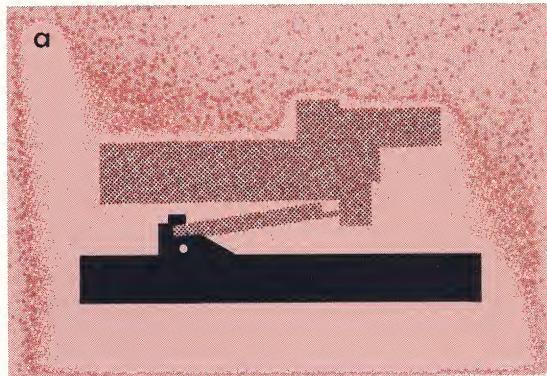
COMPATIBLE CIRCUITS — A range of standard compatible circuits are available for the L-424 and L-414 Magnetic-Disc Memory Systems. Example: Nand gate, nand gate expander, decode matrix, selection driver, write amplifier, data mixer, read amplifier, read amplifier feedback, flip flop, clock amplifier, read strobe delay, strobe output, line drivers, line receivers, circuit decoupler, and power delay. These circuits are organized and packaged according to customer interface requirements.

OPERATION

When a disc is not rotating (a), the heads are held in contact with the metallic recording surface by a reed spring whose tension, for each bar head, is preadjusted. In the contact position, the low-friction surface prevents the heads from damaging the disc tracks.

When the disc rotates (b), the heads "fly" over the track, riding on an air cushion approximately 0.0001-inch thick. The design of the heads and their adjustable mountings is such that the head-to-disc gap remains constant during operation; the flying action of the heads automatically compensates for inherent variations in the run-out of the disc and for any unbalanced temperature differentials between the head mounting plate and recording surface of the disc.

Track access is controlled by addressing from electronic switching circuits, control logic circuits, and buffers that are wired to the heads.



COMPONENTS DIVISION

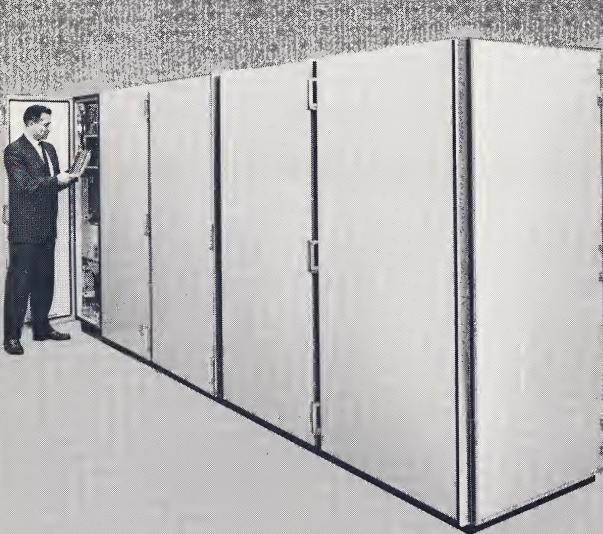
**GP GENERAL
PRECISION INC.**

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LIBRASCOPE engineering data



LIBRAFILE 4800 mass memory.

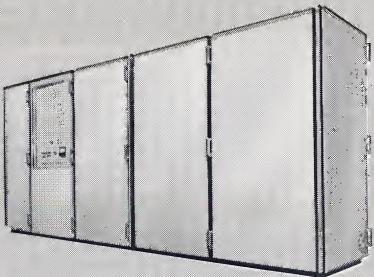
LIBRAFILE 4800 mass memory

DESCRIPTION—The LIBRAFILE 4800 mass memories produced by Librascope Group of General Precision, Inc., are large-capacity, high-speed, random-access information storage systems. A LIBRAFILE 4800 mass memory consists of two principal elements: (1) a mass-memory unit to provide data storage, and (2) a controller unit that provides necessary interface, control, and read/write electronics.

The memory element of the 4800 is comprised of six aluminum discs coated with nickel cobalt. The discs, which rotate at 900 r.p.m., measure 48" in diameter and $\frac{1}{2}$ " in width. The discs are mounted on a common shaft. Both faces are used for storage. Each 6-disc file can store up to 400 million bits of information, depending on the number of heads used and the specific data organization. Any number of files can be combined into a single system (up to 16 on a single trunk line). Files can be added as the need arises. The memory element is available with or without master-control electronics.

The technique of information retrieval is either fixed-address search or search-by-record content, depending on the master-control electronics used. Average access time is 35 milliseconds. Search-by-record content is an exclusive General Precision/Librascope technique that permits any desired field to be used as the access key, so that it is not necessary to know *where* the data is stored, but only *what* you wish to find. This obviates the need for a costly flagging and table-look-up program, conserves space in the central processing unit's main-frame memory, and permits simultaneous off-line search.

The LIBRAFILE 4800 mass memory features a "flying-head-per-track." The read/write heads are mounted on plates interleaved between the discs. They ride on a cushion of air 0.0001" thick when the disc rotates. The number of heads depends on the total bit-storage requirements of the particular application.



LIBRAFILE 4800

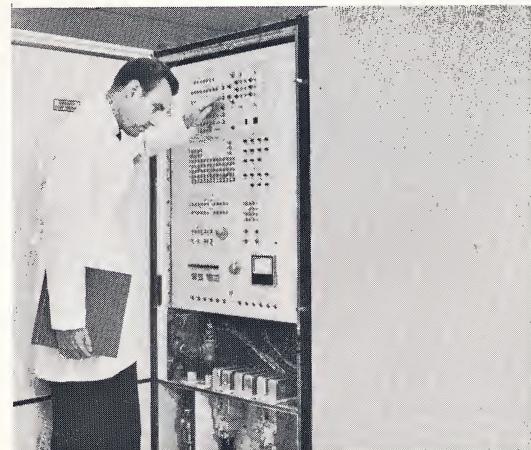
mass memory

LIBRAFILE 4800 mass memory.

APPLICATIONS—General Precision/Librascope LIBRAFILE 4800 mass memories can be used wherever an extremely large amount of data must be stored, when information retrieval in minimal time is required, or when high sustained transfer rates are desired. The 4800 files can be used with any data processing system, whether already in use or scheduled to be installed in the future to provide faster, more accurate, more reliable operation with greater storage capacity.

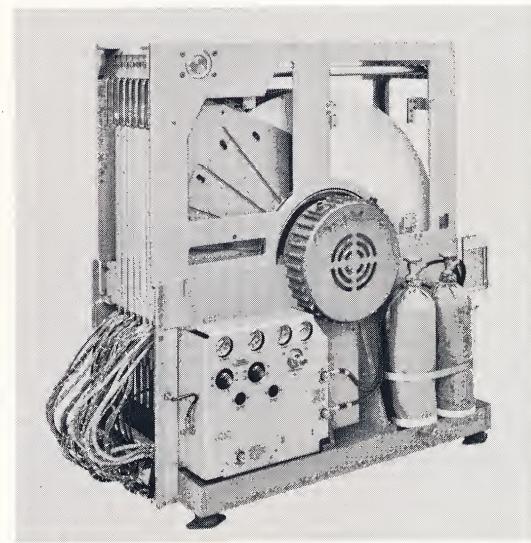
For example, 4800 disc files are a key part of Librascope's AN/FYQ-11 Data Processing Set installed in USAF's 473L command-and-control system in the Air Force Command Post at the Pentagon. More than a million headbar hours have been logged without a single headbar failure. And, a scheduled installation at the Atomic Energy Commission's Lawrence Radiation Laboratory will provide a common data base for eight powerful computers, enabling many scientists and engineers to "share" the system on an almost simultaneous basis.

*Technician checks control panel
of LIBRAFILE 4800 electronics unit.*



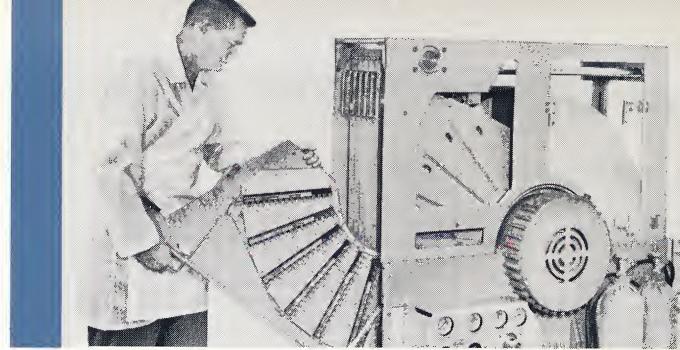
TYPICAL CONFIGURATION—The exact configuration of a LIBRAFILE 4800 mass memory depends on the requirements of the particular application. A typical configuration (detailed specifications are given on the back of this data sheet) consists of two 6-disc files, each storing in excess of 400-million bits; and a controller with the necessary interface, control, and read/write electronics. The fixed-address-search mode of data retrieval is used. The disc file is housed in three cabinets, one for the master-control electronics, and one for each 6-disc file. There is a total of 5184 tracks of information in each file, containing 79,040 bits per track. For each disc face, there are 432 read/write heads, mounted 12 (plus a spare) per bar, 6 bars per radial column, 6 columns per disc face. The entire system is tap water cooled.

*Memory unit of LIBRAFILE 4800 mass memory
shown with cabinets removed.*



LIBRAFILE 4800

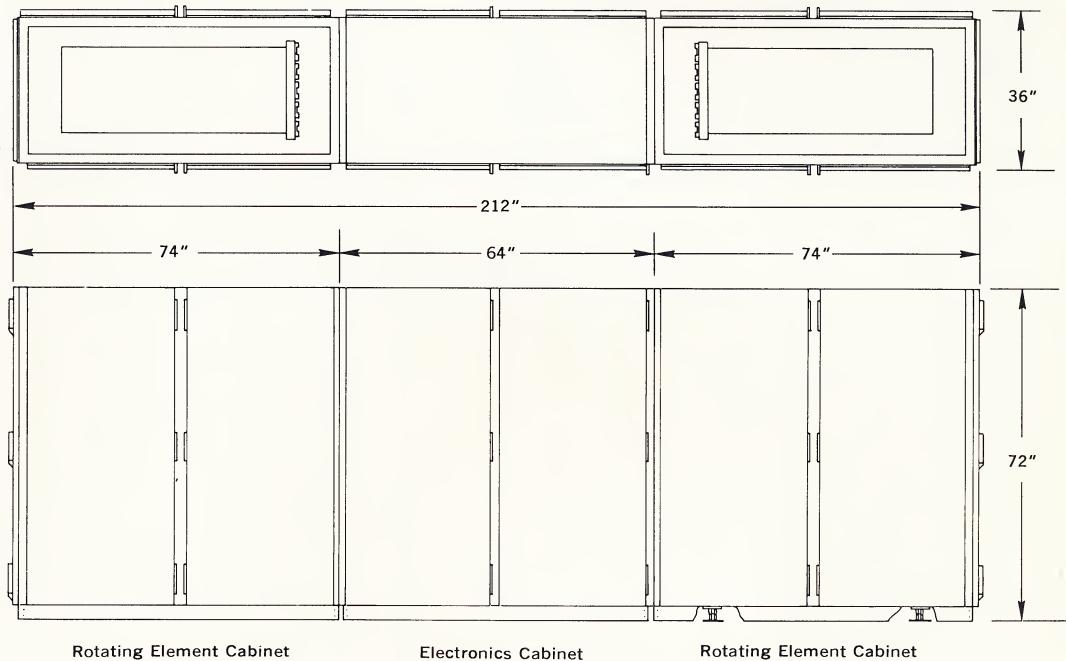
mass memory



Head-mounting plates of a LIBRAFILE 4800 mass memory retracted for convenient maintenance.

SPECIFICATIONS FOR A TYPICAL LIBRAFILE 4800 MASS MEMORY

A typical LIBRAFILE 4800 configuration consists of (1) two 6-disc files, each storing in excess of 400-million bits, and (2) a controller with the necessary interface, control, and read/write electronics. The fixed-address-search mode of data retrieval is employed.



Installation diagram of a typical LIBRAFILE 4800 mass memory.

I. PHYSICAL SPECIFICATIONS

Size of each of 2 disc-file cabinets:	74 in. wide x 72 in. high x 36 in. deep
Size of electronics cabinet:	64 in. wide x 72 in. high x 36 in. deep
Combined size of 3 cabinets:	212 in. wide x 72 in. high x 36 in. deep
Weight of each of 2 disc-file cabinets:	2894 lbs.
Weight of electronics cabinet:	1750 lbs.
Combined weight of 3 cabinets:	7538 lbs.

II. POWER REQUIREMENTS

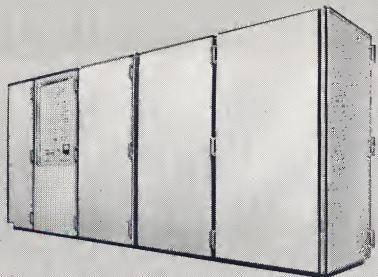
Primary power source:	3 phase, 208 volts $\pm 10\%$ phase-to-phase, wye 4-wire, 60 ± 2 cps.
Disc file power:	3.5 KVA; 10 amps/phase
Electronics power:	2.5 KVA; 7 amps/phase
Motor starting:	100 amps/phase (approx.)
15 amp. convenience outlets are provided on the electronics cabinet.	

III. ENVIRONMENTAL SPECIFICATIONS

Ambient temperature:	+55 to +100° F.
Temperature gradient:	15° F. per hr. max.
Relative humidity:	40 to 80%
Cooling water:	5 gal. per min. (approx.); inlet temperature not to exceed 60° F.

IV. DISC-FILE UNIT SPECIFICATIONS

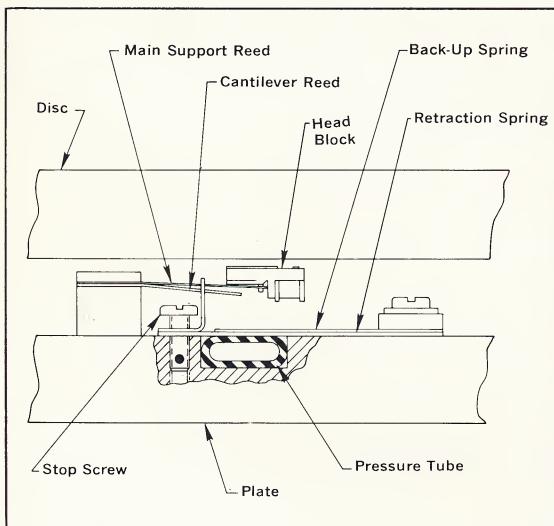
Disc dimensions (6 discs per cabinet):	1/2 in. thick x 47.5 in. dia.
Magnetic media:	Electroless cobalt
Speed:	900 rpm nominal
Heads:	Fixed; 0.015 in. track width; C.T.; bifilar wound; integral selection diodes
Disc mounting:	6 on a common shaft, with drive motor at each end
Drive motors:	Both motors used for start-up. When speed is reached, one may be cut out and used for stand-by



LIBRAFILE 4800 mass memory.



Technician wires one of 13 magnetic heads used in LIBRAFILE 4800 head bar.



Drawing of head block in retracted position.

LIBRAFILE 4800

mass memory

DISC FILE ORGANIZATION

TYPICAL LIBRAFILE 4800 CONFIGURATION

Word length:	36 bits (9 x 4)
Tracks/word:	9
Bits/track/word:	4
Words/sector:	32
Data bits/sector:	128
Parity:	1 bit
Spacer:	1 bit
Total bits/sector:	130
Sectors/revolution:	608
Bits/track:	79,040
Tracks/file:	5,184
Total bits/file:	409,743,360 including spacer and parity
Data bits/file:	403,439,616
Data bits/2 files:	806,879,232
Spare heads and data tracks/file:	300
Total heads and data tracks/file:	5,484
Clock rate:	1.13 Mc
Data transfer rate:	10.17-million bits/sec.*
Bit density:	891 bits/in. (approx.)**
Access time:	70 ms. max. 35 ms. avg.
Track width:	0.015 in.
Track guard:	0.006 in.
Tracks/in.:	48

*Based on 9-head parallel transfer. Single-head series transfer rate is equal to the clock rate: 1.13-million bits/sec.

**Spare data tracks that are nearest the hub have a density of 1000 bits/in.

COMPONENTS DIVISION

**GENERAL
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